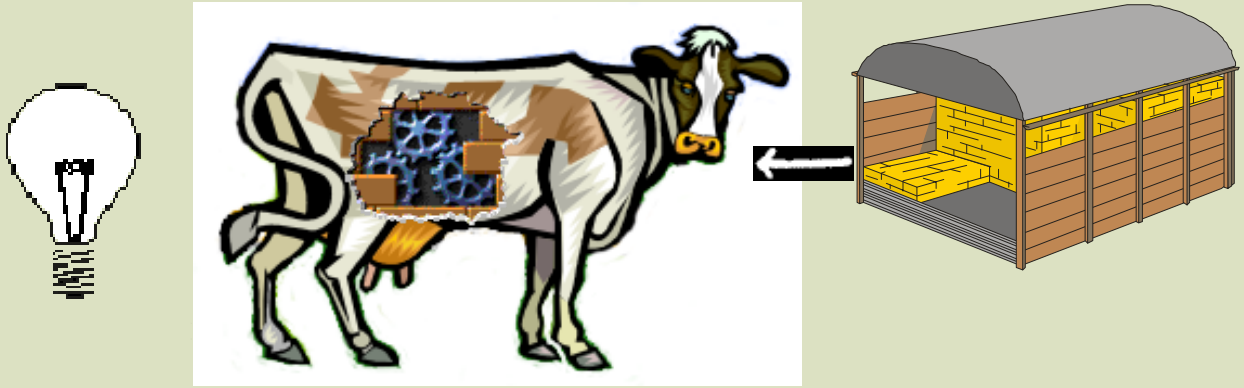

Biogas Production on Wisconsin Farms

An Overview of Activities

Larry Krom
Business Sectors Manager
Focus on Energy
Renewable Energy Program

AgStar National Conference
Madison, WI

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Farm Digester Electricity Production

16 farm digesters are currently in operation, representing 5,975 kW of rated capacity.

5 farm digesters are under construction or in start-up, representing 1,850 kW of rated capacity *plus* 400 kW of peaking capacity.

15 additional farm digesters are planned.

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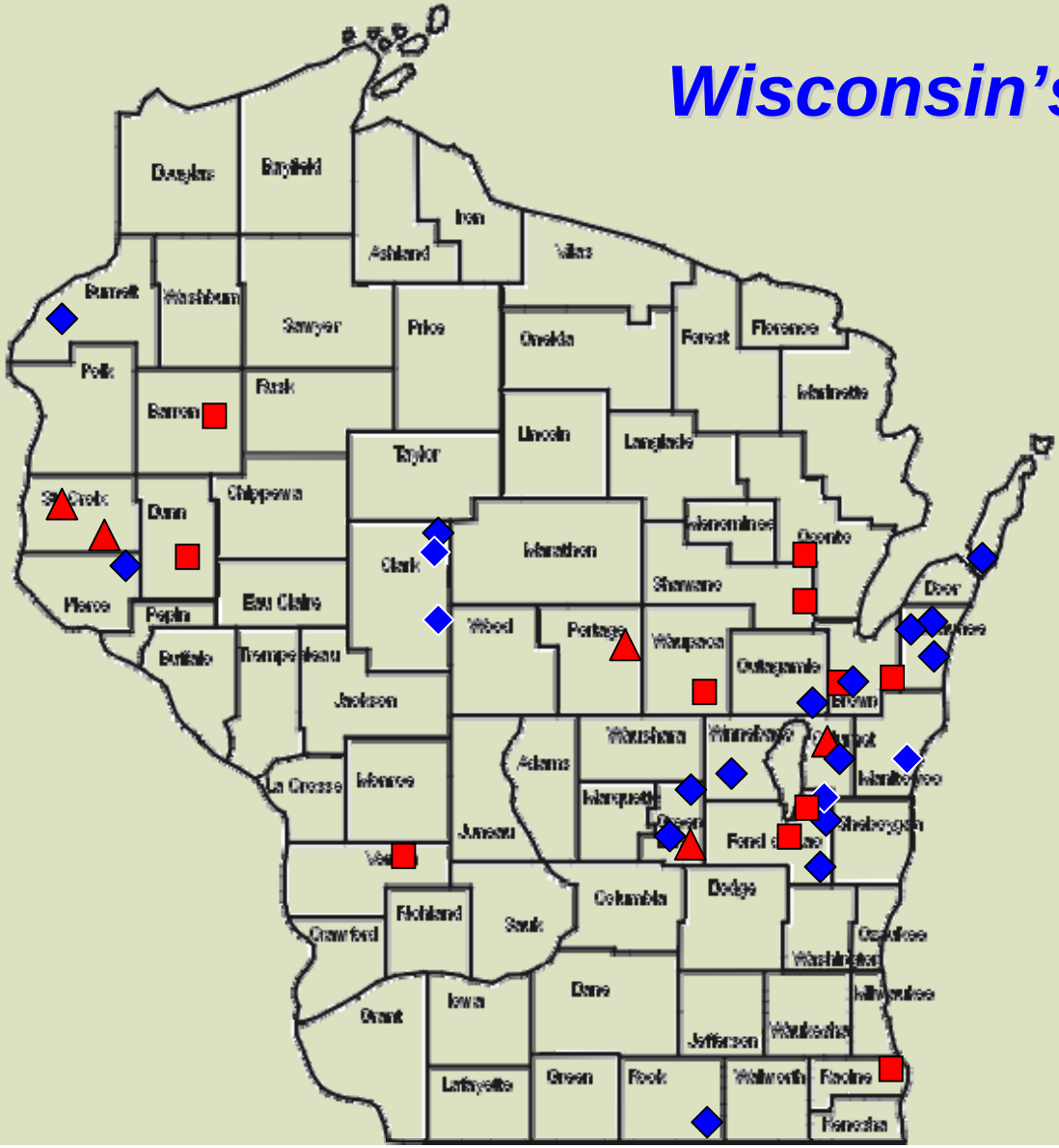
Wisconsin's Farm Digester Projects



- 11 - Existing Digesters
- 5 - Existing Digesters, capacity upgrades
- 20 - New Digesters, in construction or planned

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Operational Digesters in Wisconsin

Farm Name	Farm Type	Digester Type
Double S Dairy	dairy (730)	meso-modified plug flow
Stencil Farm	dairy (1,200)	meso-modified plug flow
Tinedale Farms	dairy (2,400)	TPAD → meso-mod plug flow
Holsum Dairy	dairy (3,000)	meso-modified plug flow system
Baldwin Dairy	dairy (1,100)	cov. lagoon → meso-mod plug flow
Emerald Dairy	dairy (1,600)	cov. lagoon → meso-mod plug flow
Gordondale Farms	dairy (800)	meso-modified plug flow
Vir-Clar Farms	dairy (1,350)	meso-complete mix
Quantum Dairy, LLC	dairy (1,200)	meso-modified plug flow
Five Star Dairy	dairy (1,000)	thermo-complete mix
Wild Rose	dairy (1,000)	thermo-complete mix
Maple Leaf Farms	duck (500,000)	meso-complete mix

Operational Digesters in Wisconsin

Farm Name	Farm Type	Digester Type
Norswiss Digester, LLC	dairy (1,300)	thermo-complete mix
Suring Community Dairy	dairy (1,000)	meso-complete mix
Green Valley Dairy	dairy (2,500)	meso-complete mix
Lake Breeze Dairy	dairy (3,000)	meso-modified plug flow

WI Anaerobic Digester Grants - Farm Bill 2003

Tidy View Dairy	Outagamie Co.	$99,950
Biopower (Green Valley), LLC	Shawano Co.	$179,700
Quantum Dairy, LLC	Waupaca Co.	$205,991
Burr Oak Hills Dairy	Rock Co.	$90,000
Schopf's Hilltop Dairy, LLC	Door Co.	$240,589
Pagel's Ponderosa Dairy, LLC	Kewaunee Co.	$99,950
Omro Dairy	Winnebago Co.	$99,950
Vir-Clar Farm	Fond du Lac Co.	$299,580

WI Anaerobic Digester Grants - Farm Bill 2004

Norswiss Digester, LLC	Rice Lake, Barron Co.	$180,000
Stargest Power, LLC	Elk Mound, Dunn Co.	$180,000
Emerald Dairy II, LLC	New Richmond, St. Croix Co.	$500,000
Baldwin Dairy, LLC	Baldwin, St. Croix Co.	$214,018
Dic-Wisco Farms, Inc.	Dorchester, Clark Co.	$254,768
Ducat Farms	Luxemburg, Kewaunee Co.	$247,018
Bach Digester, LLC	Dorchester, Clark Co.	$180,000
Dairy Dreams, LLC	Casco, Kewaunee Co.	$494,000
Redtail Ridge Dairy	Malone, Fond du Lac Co.	$225,268
Gordondale Farms	Nelsonville, Portage Co.	$124,669

WI Anaerobic Digester Grants – Farm Bill 2004 cont.

Lake Breeze Dairy, LLC	Malone, Fond du Lac Co.	$500,000
Son-Bow Farms, Inc.	Spring Valley, Pierce Co.	$253,268
Dairyland Farm, LLC	New Franken, Brown Co.	$260,741
Suring Community Dairy	Suring, Oconto Co.	$275,500
Four Cubs Farm	Grantsburg, Burnette Co.	$184,268
Hilltop Dairy	Markesan, Green Lake Co.	$275,500
Trillium Hill Farm	Berlin, Green Lake Co.	$196,768

WI Anaerobic Digester Grants - Farm Bill 2005

Bonde Acres Dairy	Newton, Manitowoc Co.	$87,425
Clover Hill Dairy, LLC	Campbellsport, Fond du Lac Co.	$280,993
Holsum Dairies, LLC	New Holstein, Calumet Co.	$500,000
Norm-E-Lane, Inc.	Chili, Clark Co.	$439,150

Deere Ridge Farm

Nelsonville, WI

mesophilic

modified plug-flow, 150 kW

GHD, Inc.

Double S Dairy

Markesan, WI

mesophilic, modified plug-flow, 200 kW

GHD, Inc.

Quantum Dairy

Weyauwega, WI

mesophilic

modified plug-flow

200 kW

GHD, Inc.

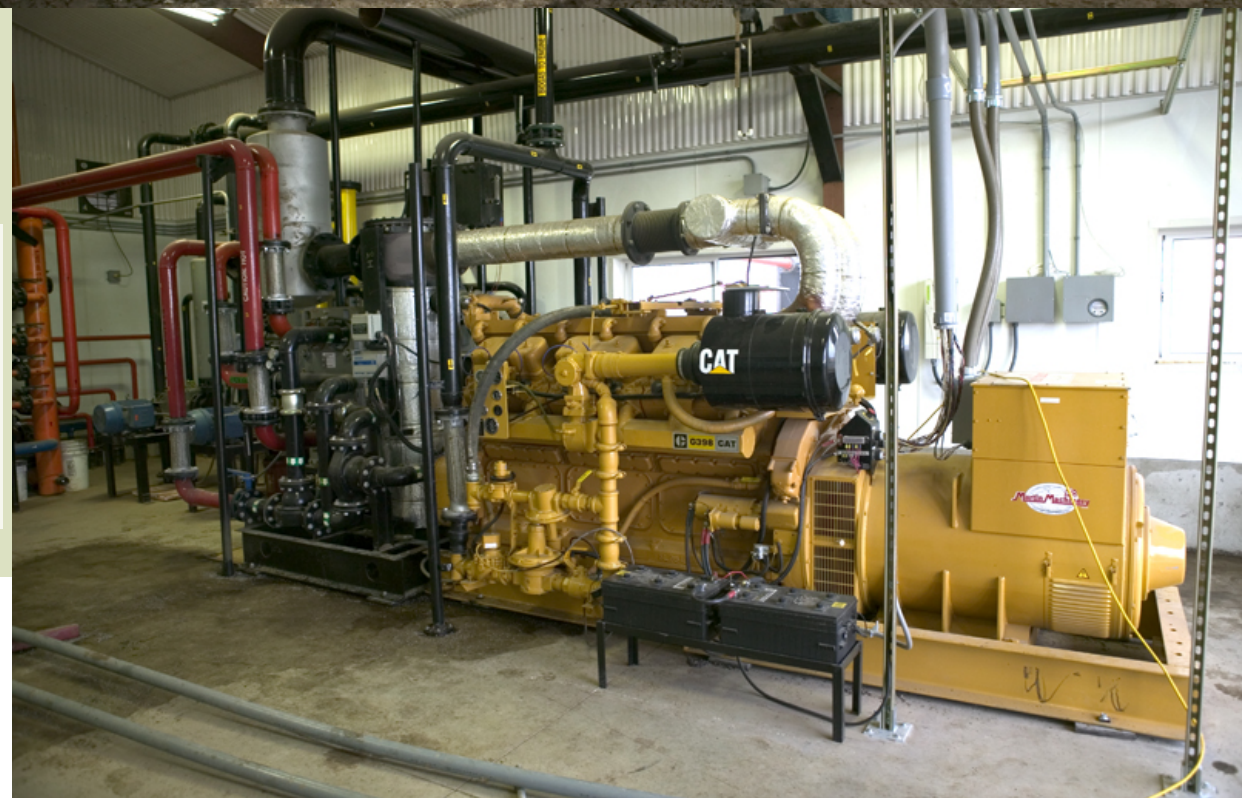
Holsum Dairy

Hilbert, WI

mesophilic

modified plug-flow; 700 kW

GHD, Inc.



Lake Breeze Dairy

Malone, WI

mesophilic

modified plug-flow, 600 kW

GHD, Inc.

Vir-Clar Farm

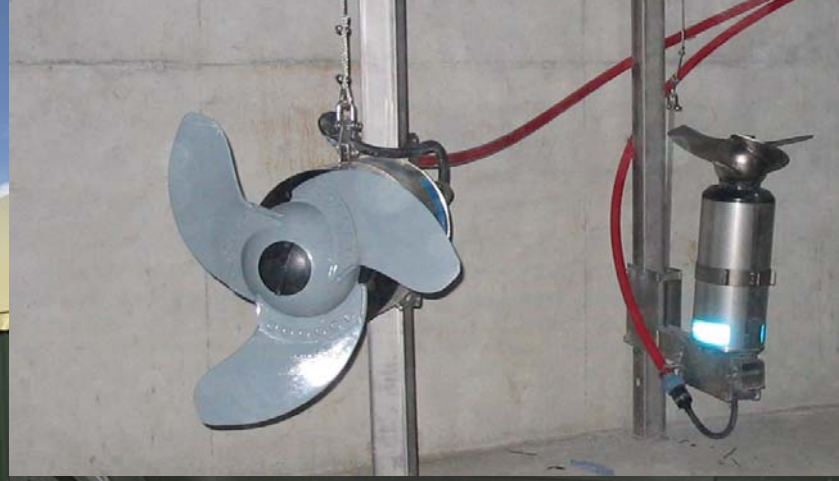
Fond du Lac

mesophilic

complete mix, 340 kW

Biogas Nord GmbH

Vir-Clar Farm



Wild Rose Dairy

La Farge, WI

thermophilic with co-digestion

complete mix, 775 kW

Microgy Cogen Systems, Inc.

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Five Star Dairy

Elk Mound, WI

thermophilic with co-digestion

complete mix, 775 kW

Microgy Cogen Systems, Inc.

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Suring Dairy

Suring, WI

mesophilic

complete mix, 250 kW

American Biogas Co., Inc.

Green Valley Dairy

Green Valley, WI

mesophilic

complete mix, 340 kW

Biogas Nord, GmbH

Focus on Energy Funded AD Projects

Projects (one utilizes only thermal energy)	**13**
Total Electric Capacity, kW	**4,650**
Total Electric Energy, kWh/year	**36,661,000**
Homes Powered (ave. 10,000 kWh/y per home in WI)	**3,666**

Ave. Engine-Generator Capacity, kW	**375**
Ave. Herd Size, cows	**1,740**
Ave. System Cost, $	**$1,693,000**
Ave. System Cost per kW, $/kW	**$4,515**
Ave. System Cost per Cow, $/cow	**$973**
Ave. System Energy per Cow per Day, kWh/cow/day	**5**
Ave. System Utilized Heat per Year, therm/year	**23,700**

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Wisconsin Program Activities

- **Project support and technical assistance**
- **Farm bill funding application assistance**
- **Statewide interconnection rules and applications**
- **Equipment grants and feasibility grants**
- **Electricity tariff and PPA barrier reduction**
- **Technical studies – data collection & dissemination**
- **Partnerships & consortiums**
- **Financing barrier reduction**
- **Forums for the farm digester interest community**
- **Policy development**
- **Education**

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Program Trade Allies

- **Applied Technologies, Inc.**
- **GHD, Inc.**
- **Microgy Cogen Systems, Inc.**
- **RCM Digester, Inc.**
- **Environomics, LLC**
- **Tiry Engineering**
- **Neptune Enterprises**
- **Biogas Nord GmbH / Biogas Direct, LLC**
- **American Biogas Company, Inc. / WELTEC BioPower GmbH**
- **Clear Horizons, LLC**

Highlights of WI Farm Digester Survey

Established baseline levels of awareness and attitudes toward dairy anaerobic digesters in Wisconsin.

- **Interviews of 82 (of 240) dairy farms with 500 or more or more cows**

Number of Cows	Population	Percent of Population	Completed Surveys	Percent of Completes
500–699	132	55%	42	51%
700–970	50	21	18	22
1,000 plus	47	20	21	26
Unknown	11	5	1	1
Total	*240*	*100%*	*82*	*100%*

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Highlights of WI Farm Digester Survey

Awareness of Anaerobic Digesters

	Aware of anaerobic digesters	100%
	Know someone with a digester installed	78%
	Seen a digester at farm operation	72%
	Explored installing digester at this farm	72%
	Number of Respondents	*82*

Work performed by
PA Consulting Group, KEMA

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Highlights of WI Farm Digester Survey

Perceived Benefits of Anaerobic Digesters

Reduce odor	65%
Generate electricity	60%
Creates bedding	43%
Separates liquids and solids	13%
Can sell electricity for income	22%
Able to spread more liquid	13%
Benefits environment	10%
Easier hauling	16%
Positive public image	2%
Other	6%
Number of Respondents	*82*

Note: Amounts do not total 100% due to respondents giving multiple responses.

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Highlights of WI Farm Digester Survey

Perceived Negative Aspects of Anaerobic Digesters

Upfront cost of installation	62%
Difficult or costly to maintain	54%
Problems with technology	12%
Not cost effective	10%
Issues with negotiating utility rates	9%
Bedding breeds bacteria	6%
Stray voltage	4%
Doesn't reduce odor enough	2%
Incompatible with sand bedding	2%
Other	13%
Number of Respondents	*82*

Note: Amounts do not total 100% due to respondents giving multiple responses.

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Highlights of WI Farm Digester Survey

Reasons for Not Installing an Anaerobic Digester in Next Two Years

Cost	39%
Technology a Barrier	27%
Farm Too Small	16%
Interested or Invested in Different MM technology	16%
Sand Bedding an Issue	10%
Doesn't Perceive Need for AD at Farm	10%
Not Enough Info	6%
Have Other Investments	6%
Still Evaluating Available Information	6%
Need Better Financing	4%
Looking to explore joint venture with other business	4%
Other	6%
Power Prices	2%
Number of Respondents	*51*

Note: Amounts do not total 100% due to respondents giving multiple responses.

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WI Utility Electric Buyback Tariffs

Company	Rate	Size	Annual	Annual	On-peak	Off-peak	Includes	Average
			on-peak	*off-peak*	*$ per kWh*	*$ per kWh*	*RE Credits*	*$ per kWh*
Xcel	Pg-2	> 100 kW	3059 h	5707 h	$0.0828	$0.0317	NA	$0.0495
WE-Energies	CGS 1	> 20 kW	3059 h	5707 h	$0.09053	$0.02546	NA	$0.0482
WE Energies	CGS 5 Bio	< 800 kW	3059 h	5707 h	$0.080	$0.049	Yes	$0.060
WPS	PG-2	> 20 kW	3850 h	4916 h	$0.103	$0.0327	NA	$0.063
Alliant	PgS-1	> 20 kW	3569 h	5197 h	$0.0616	$0.0252	NA	$0.040
Alliant	Pgs-6 Bio	< 800 kW	3569 h	5197 h	$0.080	$0.049	Yes	$0.062
MGE	Pg-1	> 20 kW	2803 h	5963 h	$0.078	$0.041	NA	$0.053
MGE	Pg-3 RE	> 20 kW			$0.061	$0.061	Yes	$0.061

1-30-06

Utility tariffs may change with each rate case filing a utility has with the PSCW. It is a good idea to check the latest rate by following the utility links found at the PSCW's website at:

http://psc.wi.gov/apps/tariffs/content/elelist.aspx

Wisconsin Estimated Market Potential

Farm Size	10 year Potential
54 farms with 1000 cows or more	**13.5 MW** **106,000,000 kWh** *10,600 WI homes*
186 farms with 500 – 999 cows	**27.9 MW** **220,000,000 kWh** *22,000 WI homes*
Less than 400 farms with 357 – 499 cows **- Livestock Facility Siting Law - s. 93.9, Stats** **- DATCP rule "ATCP 51"**	? MW *? kWh*

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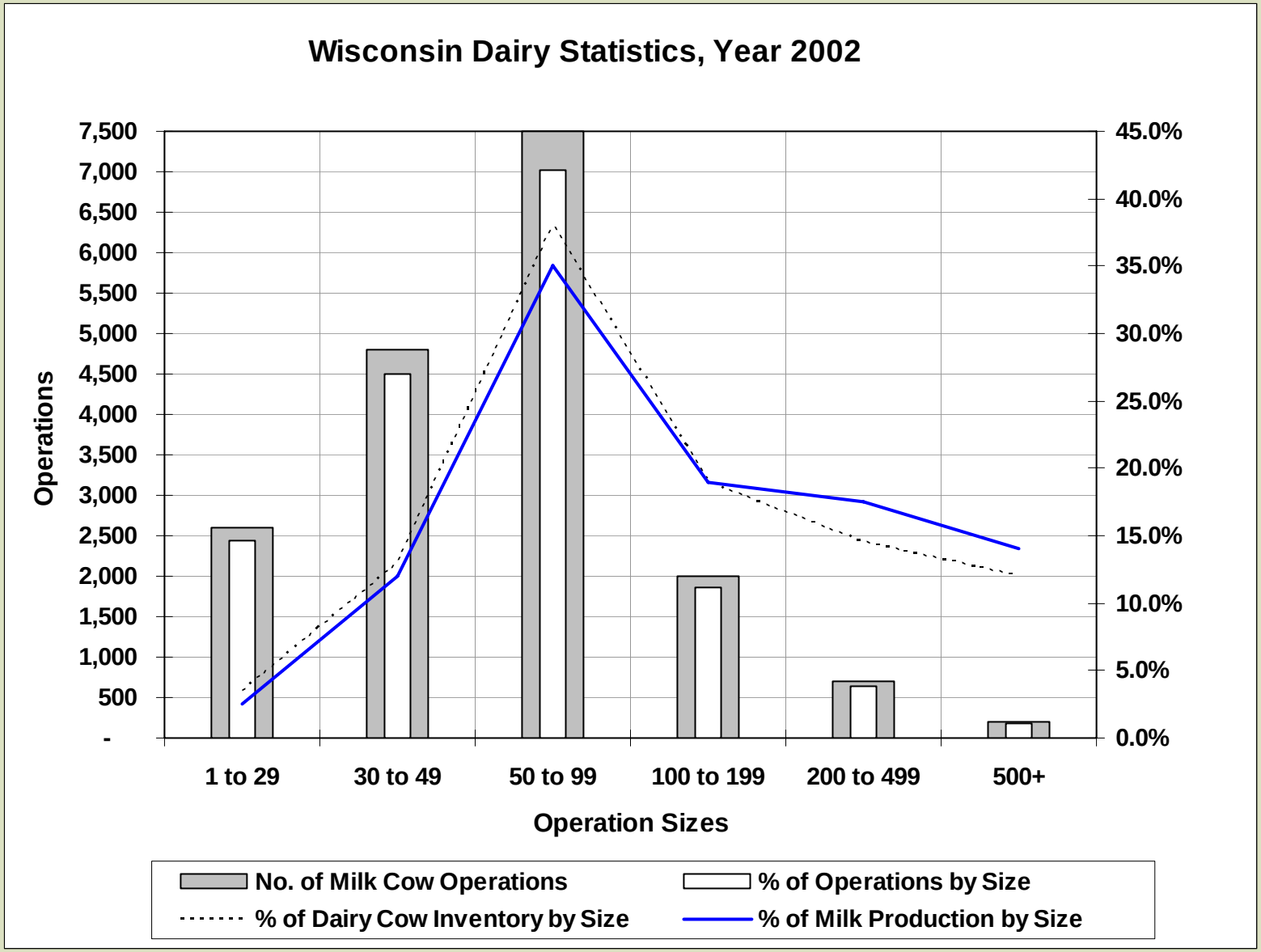

WI Farm Digester Conclusions

- **May bring farms up to a higher environmental standard**
- **Provides many non-cash-flow benefits, e.g., reduced odors**
- **Creates a diversified farm income from distributed generation**
- **Simple AD systems are generally more stable**
- **Routine maintenance of an engine-generator and digester is critical to success**
- **3-phase electric distribution systems are required**
- **Some electric distribution systems may not be able to accept full generator output at all times**
- **Farm digesters with CHP are economically viable – payback of 6 years possible (without grants)**

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- **WI Dept. of Agriculture, Trade and Consumer Protection**
- **University of Wisconsin – Extension**
  - Biological Systems Engineering
- **WI Technical Colleges**
- **WI Department of Administration**
- **USDA-Rural Development**
- **Wisconsin's electric utilities**
- **Energy Center of Wisconsin**
- **Resource Conservation & Development Groups**
- **Farm digester contractors**

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